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Engineering Design File

PROJECT FILE NO. 020996

Staging, Storage, Sizing and Treatment Facility

Access Road and Site Pavement Ballast Requirements

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

Idaho National Engineering and Environmental Laboratory

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ENGINEERING DESIGN FILE

PROJECT FILE NO. 020996
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PROJECT/TASK **SSSTF**

SUBTASK **BALLAST REQUIREMENT - ACCESS ROAD & SITE PAVEMENT**

TITLE **SSSTF Access Road & Site Pavement Ballast Requirements**

SITE AREA **INTEC** BUILDING NO. _____ SSC IDENTIFICATION/EQUIPMENT NO. _____

SUMMARY

This Engineering Design File (EDF) contains the calculations for the ballast requirements for the Staging, Storage, Sizing and Treatment Facility (SSSTF) access road and site pavement. The assumption used to calculate the balast requirements are as follows:

1) Excavate soil down to the gravel interface.
2) The R-values used are:
   R = 55 for the subgrade
   R = 55 for the pit run gravel (per Craig Bean)
   R = 80 for the crushed aggregate base
   R = 80 for the plant mix
3) A medium vehicle classification
4) 150 commercial vehicles per day per lane

Conclusions:

The minimum ballast required for the SSSTF access road and site pavement is 0.25 ft. of plantmix, 0.5 ft. of base, and 0.6 ft. of borrow. However, it is recommended to use 1.0 ft. minimum of borrow to comply with geometry requirements for a high profile in the case of snow buildup or flooding. Actual gravel borrow depth used will be greater than 1-ft. to match the design profile and the gravel interface.

REFERENCES:

1. State of Idaho, Idaho Transportation Department Materials Manual

NPH PERFORMANCE CATEGORY (DOE-STD 1021) ☐ PC-0 ☐ PC-1 ☐ PC-2 ☐ PC-3 ☐ PC-4 ☒ Not Applicable

SAFETY CATEGORY (MCP-540) ☐ Safety Class ☐ Safety Significant ☒ Low Safety Consequence ☐ Consumer Grade ☐ Not Applicable

KEYWORDS (e.g. area, structure no., general subject matter, etc.): SSSTF, Pavement, Ballast Requirements

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BALLAST REQUIREMENTS
SSSTF ACCES ROAD & SITE PAVEMENT

I. ASSUMPTIONS

1. Excavate soil down to the gravel interface
2. R-Values
   a. Subgrade: R = 55
   b. Pit Run Gravel: R = 55 (per Craig Bean)
   c. Crushed Aggregate Base: R = 80
   d. Plantmix: R = 80
3. Medium vehicle classification
4. 150 commercial vehicles per day per lane

II. TRAFFIC EVALUATIONS

1. Use Idaho Transportation Pavement Design 16.500
2. See attached calculations

BALLAST REQUIREMENTS
SSSTF ACCESS ROAD & SITE PAVEMENT

I. ASSUMPTIONS

1. Excavate soil down to the gravel interface

2. R-Values
a. Subgrade: R = 55
b. Pit Run Gravel: R = 55 (per Craig Bean)
c. Crushed Aggregate Base: R = 80
d. Plantmix: R = 80

3. Medium vehicle classification

4. 150 commercial vehicles per day per lane

II. TRAFFIC EVALUATIONS

1. Use Idaho Transportation Pavement Design 16.500

2. Calculations:

Classification: Ref. 16-510.2

	% of Commercial Vehicles Volume (Commercial Annual Daily Traffic (CADT))		
	Two Axle	Five Axle	
Medium	50-70%	10-25%	100% of CADT in each lane

Commercial Vehicles per Day: 150 (assumed)

Traffic Index: 9
from Figure 16-510.2.2.1

III. DESIGN PAVEMENT BY R-VALUE

Plant Mix R-Value 80

Compute flexible pavement thickness: GE = 0.0032(TI)(100-R)

Design adjustment for climatic factor: Design Thickness = R-Value Thickness * F

F= 1.05 for Region 2 from Figure 16-510.5.1

GE= 0.0032*9*(100-80)*1.05
GE= 0.605 ft

Calculate layer thickness by applying the substitution ratio for the plant mix

Substitution Ratio for plant mix = 1.8

T= GE/Substitution Ratio

T= 0.61/1.8

T= 0.3 ft plantmix

However, use 0.25 ft plantmix because this is a low volume road and the structural capacity is adequate by adding additional granular borrow.

Base R-Value 80

Compute flexible pavement thickness: GE = 0.0032(TI)(100-R)

Design adjustment for climatic factor: Design Thickness = R-Value Thickness * F

F= 1.05 for Region 2 from Figure 16-510.5.1

GE= 0.0032*9*(100-80)*1.05
GE= 0.605 ft

Calculate layer thickness by applying the substitution ratio for the base

Substitution Ratio for Base = 1

T= GE/Substitution Ratio
T= 0.605/1
T= 0.6 ft base

Pit-Run Gravel R-Value 55

Compute flexible pavement thickness: GE = 0.0032(TI)(100-R)

Design adjustment for climatic factor: Design Thickness = R-Value Thickness * F

F= 1.05 for Region 2 from Figure 16-510.5.1

GE= 0.0032*9*(100-55)*1.05
GE= 1.36 ft

Calculate layer thickness by applying the substitution ratio for the pit-run gravel

Substitution Ratio for Pit-Run Gravel = 0.75

T= GE/Substitution Ratio
T= 1.36/0.75
T= 1.8 ft pit-run gravel

The typical section is then composed of:

	0.25 ft plant mix pavement	* 1.8 =	0.5 ft GE
	0.6 ft crushed aggregate base	* 1.0 =	0.6 ft GE
+	1.8 ft pit-run gravel	* 0.75 =	1.36 ft GE
	2.7 ft actual total thickness		2.4 ft GE >> 1.36 ft

Back Check

Subgrade R = 55 Must Strip 1 ft of Top Soil
TI = 9
GE = 0.0032(TI)(100-R)1.05
GE = 0.0032(9)(100-55)1.05
GE = 1.36 ft

From Figure 16-510.3.2 GE = 1.30 therefore use 1.36 ft — 1.36 ft GE required

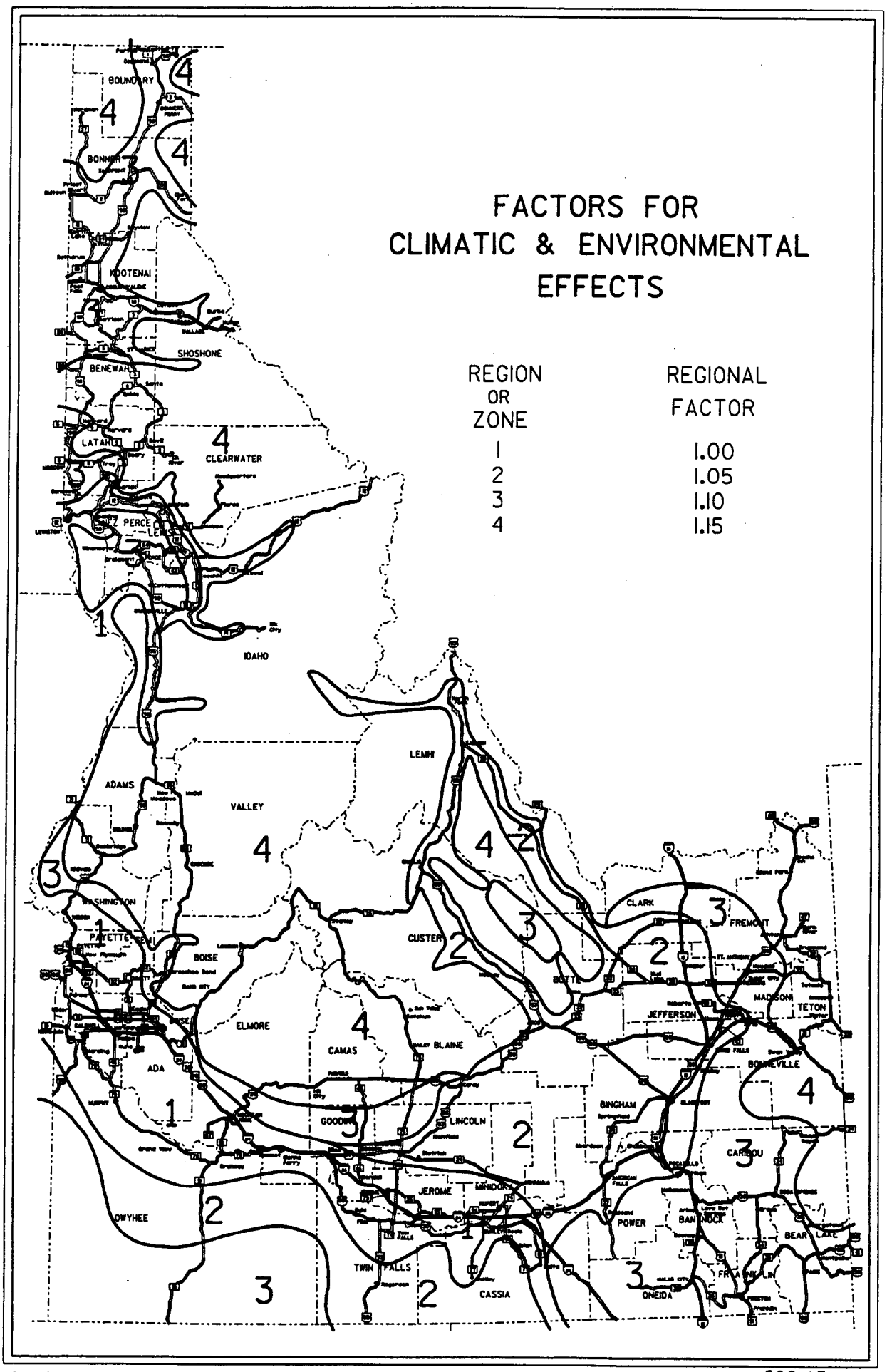
Use 0.25 ft Plantmix x 1.8 = 0.45 ft GE — 0.45 ft
Use 0.5 ft 3/4-inch crushed aggregate base = 0.50 ft GE — + 0.5 ft
0.95 ft GE plantmix & base

Net GE
For Granular Borrow = 0.32/0.75 = 0.04 use 0.5 ft min.

Minimum ballast =
0.25 ft plantmix
0.50 ft base
+ 0.60 ft borrow
1.35 ft < 1.36 ft

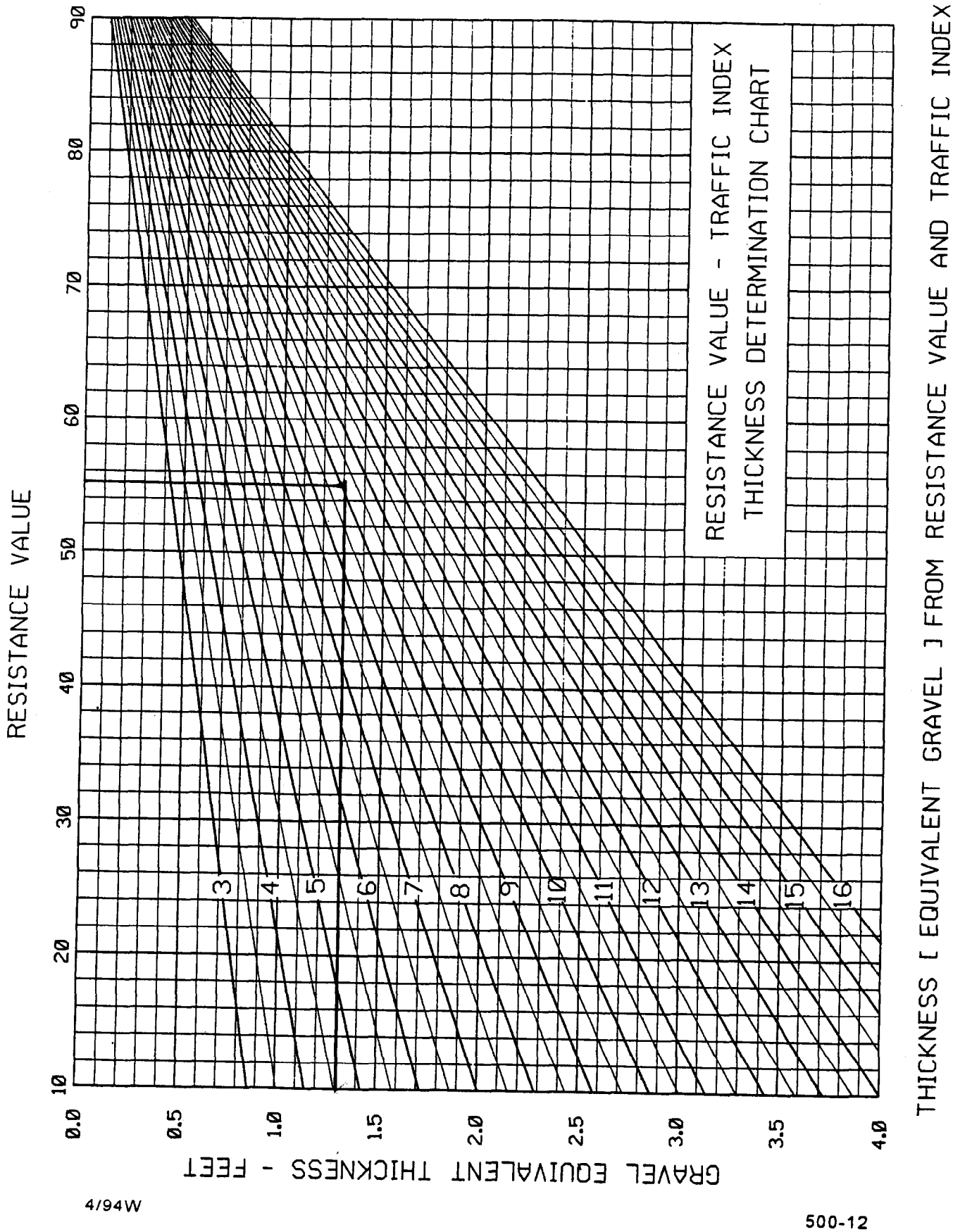
However recommend 1.0 ft granular borrow as a minimum and it will be more than this to comply with geometry requirements such as high profile for snow and flooding.

Therefore minimum ballast =
0.25 ft plantmix
0.50 ft base
+ 1.00 ft borrow
1.75 ft > 1.36 ft OK


FACTORS FOR
CLIMATIC & ENVIRONMENTAL
EFFECTS
REGION OR ZONE
REGIONAL FACTOR
1 1.00
2 1.05
3 1.10
4 1.15
BOUNDARY
BONNER
KOOTENAI
SHOSHONE
BENEWAH
LATAH
CLEARWATER
NEZ PERCE
LEWIS
IDAHO
ADAMS
VALLEY
WASHINGTON
PAYETTE
BOISE
ELMORE
ADA
OWYHEE
LEMHI
CUSTER
CAMAS
BLAINE
GOODING
LINCOLN
JEROME
MINIDOKA
TWIN FALLS
CASSIA
CLARK
FREMONT
MADISON
JEFFERSON
TETON
BONNEVILLE
BINGHAM
CARIBOU
POWER
BANNOCK
BEAR LAKE
ONEIDA
FRANKLIN

FLEXIBLE PAVEMENT

Figure 16-510.3.2



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Addendum A
11.21.2001
EDF-1913

The low, medium and high vehicle classifications for pavement design are criteria developed by the Idaho Transportation Department (ITD). These criteria are developed for various classes of highways. The low classification is for State and County secondary roads with the lowest truck volumes. The medium classification is for medium volume, primary type highways with higher truck volumes. The ITD Design Guide reserves the high classification for Interstate Highways with very large truck volumes. Each classification equates two axle trucks (dump trucks) and 5 axle trucks to 18,000-lb equivalent single axle loads (ESALs). Using this data and the soils classification data, ballast requirements are developed. The actual ballast or combined thickness of pavement layers exceeds the ballast requirements for the SSSTF project. On the last page of EDF 1913, 1.75 ft of gravel equivalent is listed as the actual ballast and 1.36 ft is listed as the required ballast requirement